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RELATIONSHIP OF STUMP DIAMETER TO DIAMETER AT BREAST HEIGHT FOR SEVEN TREE SPECIES IN ARIZONA AND NEW MEXICO

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ABSTRACT

Presents equations and tables for estimating diameter at breast height from stump diameter for ponderosa pine ("yellow" and "blackjack" pine separately), Douglas-fir, aspen, white fir, southwestern white pine, and from combined data for Engelmann spruce and corkbark fir. The basic data came from five National Forests in Arizona and New Mexico, and were analyzed using weighted least squares regression techniques.

KEYWORDS: diameter measurements (stem), stump-d.b.h., conversion tables

When reconstructing temporary growth plots, or when conducting a forest inventory or a timber trespass appraisal, it is often necessary to estimate a cut tree's volume by estimating its diameter at breast height (d.b.h.) from the diameter of the remaining stump and an estimate of the height of the removed tree. An estimate of tree height can be obtained by the d.b.h.-tree height relationship of other trees in the area or by measuring the distance from the stump to the top remnants, if they exist. This paper presents estimated d.b.h. values for given stump diameters for seven tree species in Arizona and New Mexico.

DATA SOURCES AND METHODS

The data used in this study were collected from five National Forests by field crews from the Division of Timber Management, Southwestern Region, Forest Service, Albuquerque, New Mexico (table 1).

In the study area, "Blackjack" and "yellow" pines are distinguished on the basis of bark color that is related to their age, growth, and vigor rather than botanically; "blackjack" pines have very dark bark and "yellow" pines heavily plated, orange bark. Foresters in the Southwest find this distinction useful in forest management planning.

Table 1.--*Data sources.*

SPECIES	NATIONAL FOREST				
	Coconino	Tonto	Lincoln	Santa Fe	Carson
"Blackjack pine" (*Pinus ponderosa* Laws.)	X	X	X	X	X
"Yellow pine" (*Pinus ponderosa* Laws.)	X	X	X	X	X
Douglas-fir (*Pseudotsuga menziesii* var. *glauca* [Mirb.] Franco)		X	X	X	X
White fir (*Abies concolor* [Gord. and Glend.] Lindl.)			X	X	X
Southwestern white pine (*Pinus flexilis* var. *reflexa* Engelm.)			X	X	X
Aspen (*Populus tremuloides* Michx.)				X	X
Engelmann spruce (*Picea engelmannii* Parry)				X	X
Corkbark fir *Abies lasiocarpa* var. *arizonica* [Merriam] Lemm.)				X	X

Stump diameter, inside bark, was determined by averaging the measurements of the long and short axes of the stump's cross section. Stump height, measured on the uphill side, was 1.0 foot on all National Forests except the Lincoln. On the Lincoln, stump height was 1.2 feet. Each tree's d.b.h., outside bark, was measured with a diameter tape before the tree was felled.

It was hypothesized that d.b.h. is linearly related to stump diameter. Therefore, the following model was fitted to the data using least squares regression:

$$D = b_0 + b_1(D_s)$$

where D = diameter at breast height, outside bark, in inches

D_s = stump diameter, inside bark, in inches

An examination of residuals indicated that this model was appropriate, but it also revealed that the squared residuals increased as a linear function of stump diameter. Because of this, the reciprocal of stump diameter was taken as the weight in the weighted least squares regression program used for the rest of the study.

Analyses of covariance determined that data sets could be combined across National Forests for each species and that the data set for corkbark fir could be combined with that for Engelmann spruce. As a result, the data for all forests, except the Lincoln (because of the different stump height), were combined.

The range in stump diameters for each data set, final weighted least squares regression coefficients, the number of trees used in their development, and the resulting coefficients of determination are presented in table 2. Two of the data sets, "yellow" pine on the Lincoln and white pine on the Santa Fe and Carson National Forests, were weak in terms of number of trees, but the resulting equations seemed reasonable and so are included. Tabular values of these equations are given in appendix tables 3 through 14.

When these results are used, it is strongly recommended that stump diameter be computed as the average of the long and short axes. The use of a diameter tape on out-of-round stems can produce results that differ considerably from the recommended method.

Table 2.--*Data base and regression results*

Species	National Forest	Number of trees	Range in stump diameters, inside bark	Regression coefficients: b_0	Regression coefficients: b_1	R^2 Coefficient of determination
			Inches			
Southwestern white pine	Santa Fe, Carson	18	5.3 - 21.8	0.6805	0.9154	0.9560
Southwestern white pine	Lincoln	42	5.0 - 41.6	.3744	.9526	.9905
Engelmann spruce and corkbark fir	Santa Fe, Carson	161	4.7 - 24.1	.5489	.8779	.9591
"Yellow" pine	Santa Fe, Carson, Coconino, Tonto	220	7.0 - 33.0	1.8887	.9528	.9503
"Yellow" pine	Lincoln	11	11.4 - 30.7	1.0068	.9967	.9569
"Blackjack" pine	Santa Fe, Carson, Coconino, Tonto	963	4.3 - 29.2	.5520	1.0156	.9699
"Blackjack" pine	Lincoln	57	4.4 - 19.7	.6582	1.0060	.9828
Douglas-fir	Santa Fe, Carson, Tonto	115	4.7 - 25.1	.2223	1.0002	.9694
Douglas-fir	Lincoln	93	5.1 - 35.4	.6464	1.0056	.9803
Aspen	Santa Fe, Carson	145	4.6 - 21.3	.3280	.9691	.9615
White fir	Santa Fe, Carson	66	4.4 - 29.0	.4499	.9636	.9814
White fir	Lincoln	48	4.3 - 49.0	.6265	.9800	.9909

APPENDIX

TABLE 3. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
SOUTHWESTERN WHITE PINE
SANTA FE, CARSON N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.3	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1
6	6.2	6.3	6.4	6.4	6.5	6.6	6.7	6.8	6.9	7.0
7	7.1	7.2	7.3	7.4	7.5	7.5	7.6	7.7	7.8	7.9
8	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8
9	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.7
10	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7
11	10.8	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6
12	11.7	11.8	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5
13	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4
14	13.5	13.6	13.7	13.8	13.9	14.0	14.0	14.1	14.2	14.3
15	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.1	15.2
16	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
17	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1
18	17.2	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0
19	18.1	18.2	18.3	18.3	18.4	18.5	18.6	18.7	18.8	18.9
20	19.0	19.1	19.2	19.3	19.4	19.4	19.5	19.6	19.7	19.8
21	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.5	20.6	20.7
22	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.6
23	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6
24	22.7	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5
25	23.6	23.7	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4
26	24.5	24.6	24.7	24.8	24.8	24.9	25.0	25.1	25.2	25.3
27	25.4	25.5	25.6	25.7	25.8	25.9	25.9	26.0	26.1	26.2
28	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.0	27.1
29	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1
30	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0
31	29.1	29.2	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
32	30.0	30.1	30.2	30.2	30.3	30.4	30.5	30.6	30.7	30.8
33	30.9	31.0	31.1	31.2	31.3	31.3	31.4	31.5	31.6	31.7
34	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.4	32.5	32.6
35	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.5

TABLE 4. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.2-FOOT-HIGH STUMP
SOUTHWESTERN WHITE PINE
LINCOLN N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
6	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	6.9
7	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
8	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
9	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8
10	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8
11	10.9	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7
12	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7
13	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6
14	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6
15	14.7	14.8	14.9	14.9	15.0	15.1	15.2	15.3	15.4	15.5
16	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5
17	16.6	16.7	16.8	16.9	16.9	17.0	17.1	17.2	17.3	17.4
18	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4
19	18.5	18.6	18.7	18.8	18.9	18.9	19.0	19.1	19.2	19.3
20	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3
21	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.0	21.1	21.2
22	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.2
23	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.0	23.1
24	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1
25	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.0
26	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0
27	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0
28	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9
29	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
30	29.0	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8
31	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8
32	30.9	31.0	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7
33	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7
34	32.8	32.9	33.0	33.0	33.1	33.2	33.3	33.4	33.5	33.6
35	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6

TABLE 5. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
ENGELMANN SPRUCE-CORKBARK FIR
SANTA FE, CARSON N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.6	5.7
6	5.8	5.9	6.0	6.1	6.2	6.3	6.3	6.4	6.5	6.6
7	6.7	6.8	6.9	7.0	7.0	7.1	7.2	7.3	7.4	7.5
8	7.6	7.7	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4
9	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.2
10	9.3	9.4	9.5	9.6	9.7	9.8	9.9	9.9	10.0	10.1
11	10.2	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.9	11.0
12	11.1	11.2	11.3	11.3	11.4	11.5	11.6	11.7	11.8	11.9
13	12.0	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8
14	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.5	13.6
15	13.7	13.8	13.9	14.0	14.1	14.2	14.2	14.3	14.4	14.5
16	14.6	14.7	14.8	14.9	14.9	15.0	15.1	15.2	15.3	15.4
17	15.5	15.6	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3
18	16.4	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.1
19	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.8	17.9	18.0
20	18.1	18.2	18.3	18.4	18.5	18.5	18.6	18.7	18.8	18.9
21	19.0	19.1	19.2	19.2	19.3	19.4	19.5	19.6	19.7	19.8
22	19.9	20.0	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7
23	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.4	21.5
24	21.6	21.7	21.8	21.9	22.0	22.1	22.1	22.2	22.3	22.4
25	22.5	22.6	22.7	22.8	22.8	22.9	23.0	23.1	23.2	23.3
26	23.4	23.5	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2
27	24.3	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.0
28	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.7	25.8	25.9
29	26.0	26.1	26.2	26.3	26.4	26.4	26.5	26.6	26.7	26.8
30	26.9	27.0	27.1	27.1	27.2	27.3	27.4	27.5	27.6	27.7
31	27.8	27.9	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6
32	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.3	29.4
33	29.5	29.6	29.7	29.8	29.9	30.0	30.0	30.1	30.2	30.3
34	30.4	30.5	30.6	30.7	30.7	30.8	30.9	31.0	31.1	31.2
35	31.3	31.4	31.5	31.5	31.6	31.7	31.8	31.9	32.0	32.1

TABLE 6. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
"YELLOW" PINE
SANTA FE, CARSON, COCONINO, TONTO N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	6.7	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5
6	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5
7	8.6	8.7	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4
8	9.5	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.4
9	10.5	10.6	10.7	10.7	10.8	10.9	11.0	11.1	11.2	11.3
10	11.4	11.5	11.6	11.7	11.8	11.9	12.0	12.1	12.2	12.3
11	12.4	12.5	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2
12	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14.0	14.1	14.2
13	14.3	14.4	14.5	14.6	14.7	14.8	14.8	14.9	15.0	15.1
14	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
15	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.8	16.9	17.0
16	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0
17	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.8	18.9
18	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9
19	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.8
20	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8
21	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8
22	22.9	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7
23	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7
24	24.8	24.9	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6
25	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6
26	26.7	26.8	26.9	26.9	27.0	27.1	27.2	27.3	27.4	27.5
27	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5
28	28.6	28.7	28.8	28.9	28.9	29.0	29.1	29.2	29.3	29.4
29	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4
30	30.5	30.6	30.7	30.8	30.9	30.9	31.0	31.1	31.2	31.3
31	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3
32	32.4	32.5	32.6	32.7	32.8	32.9	32.9	33.0	33.1	33.2
33	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2
34	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.0	35.1
35	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1

TABLE 7. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.2-FOOT-HIGH STUMP
"YELLOW" PINE
LINCOLN N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	- - - - - - - - - - - - D.B.H. IN INCHES - - - - - - - - - - - -									
5	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
6	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
7	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
8	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
10	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
11	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9
12	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9
13	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9
14	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
15	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9
16	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9
17	18.0	18.1	18.2	18.3	18.4	18.4	18.5	18.6	18.7	18.8
18	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8
19	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8
20	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8
21	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8
22	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8
23	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8
24	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8
25	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8
26	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8
27	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8
28	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8
29	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8
30	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8
31	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8
32	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8
33	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8
34	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8
35	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8

TABLE 8. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
"BLACKJACK" PINE
SANTA FE, CARSON, COCONINO, TONTO N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5
6	6.6	6.7	6.8	7.0	7.1	7.2	7.3	7.4	7.5	7.6
7	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6
8	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6
9	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6
10	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6
11	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6
12	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.5	13.6	13.7
13	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7
14	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7
15	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7
16	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7
17	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7
18	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7
19	19.8	19.9	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8
20	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8
21	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8
22	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8
23	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8
24	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8
25	25.9	26.0	26.1	26.2	26.3	26.4	26.6	26.7	26.8	26.9
26	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9
27	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9
28	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
29	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9
30	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9
31	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9
32	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0
33	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0
34	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0
35	36.1	36.2	36.3	36.4	36.5	36.6	35.7	36.8	36.9	37.0

TABLE 9. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.2-FOOT-HIGH STUMP
"BLACKJACK" PINE
LINCOLN N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6
6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6
7	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6
8	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6
9	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6
10	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6
11	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6
12	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6
13	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6
14	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6
15	15.7	15.8	15.9	16.0	16.2	16.3	16.4	16.5	16.6	16.7
16	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7
17	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7
18	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7
19	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7
20	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7
21	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7
22	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7
23	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7
24	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7
25	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7
26	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7
27	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7
28	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7
29	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7
30	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7
31	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7
32	32.8	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8
33	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8
34	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8
35	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8

TABLE 10. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
DOUGLAS-FIR
SANTA FE, CARSON, TONTO N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1
6	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1
7	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1
8	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1
9	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1
10	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1
11	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	12.0	12.1
12	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1
13	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14.0	14.1
14	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
15	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
16	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1
17	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1
18	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1
19	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1
20	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1
21	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1
22	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1
23	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1
24	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1
25	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1
26	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1
27	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1
28	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1
29	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1
30	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1
31	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1
32	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1
33	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1
34	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1
35	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1

TABLE 11. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.2-FOOT-HIGH STUMP
DOUGLAS-FIR
LINCOLN N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6
6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6
7	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6
8	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6
9	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6
10	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6
11	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6
12	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6
13	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6
14	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6
15	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6
16	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6
17	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6
18	18.7	18.8	18.9	19.0	19.1	19.2	19.4	19.5	19.6	19.7
19	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7
20	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7
21	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7
22	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7
23	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7
24	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7
25	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7
26	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7
27	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7
28	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7
29	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7
30	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7
31	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7
32	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7
33	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7
34	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7
35	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7

TABLE 12. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
ASPEN
SANTA FE, CARSON N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	5.9	6.0
6	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0
7	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0
8	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0
9	9.1	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
10	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
11	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
12	12.0	12.1	12.2	12.2	12.3	12.4	12.5	12.6	12.7	12.8
13	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8
14	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8
15	14.9	15.0	15.1	15.2	15.3	15.3	15.4	15.5	15.6	15.7
16	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7
17	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7
18	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.5	18.6
19	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6
20	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6
21	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6
22	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5
23	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5
24	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5
25	24.6	24.7	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4
26	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4
27	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4
28	27.5	27.6	27.7	27.8	27.9	27.9	28.0	28.1	28.2	28.3
29	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3
30	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3
31	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.0	31.1	31.2
32	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2
33	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2
34	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2
35	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1

TABLE 13. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.0-FOOT-HIGH STUMP
WHITE FIR
SANTA FE, CARSON N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.3	5.4	5.5	5.6	5.7	5.7	5.8	5.9	6.0	6.1
6	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1
7	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1
8	8.2	8.3	8.4	8.4	8.5	8.6	8.7	8.8	8.9	9.0
9	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0
10	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0
11	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
12	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9
13	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.7	13.8
14	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8
15	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8
16	15.9	16.0	16.1	16.2	16.3	16.3	16.4	16.5	16.6	16.7
17	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7
18	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7
19	18.8	18.9	19.0	19.0	19.1	19.2	19.3	19.4	19.5	19.6
20	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6
21	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6
22	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5
23	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5
24	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.3	24.4
25	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4
26	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4
27	26.5	26.6	26.7	26.8	26.9	26.9	27.0	27.1	27.2	27.3
28	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3
29	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3
30	29.4	29.5	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2
31	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2
32	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2
33	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1
34	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1
35	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.8	34.9	35.0

TABLE 14. - - TREE D.B.H., OUTSIDE BARK, FROM DIAMETER INSIDE BARK AT THE TOP OF A 1.2-FOOT-HIGH STUMP
WHITE FIR
LINCOLN N.F.

STUMP DIAMETER (INCHES)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	D.B.H. IN INCHES									
5	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4
6	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4
7	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4
8	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.3
9	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.3
10	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3
11	11.4	11.5	11.6	11.7	11.8	11.9	12.0	12.1	12.2	12.3
12	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3
13	13.4	13.5	13.6	13.7	13.8	13.9	14.0	14.1	14.2	14.2
14	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
15	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
16	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2
17	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2
18	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.1
19	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1
20	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1
21	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1
22	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1
23	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.0
24	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0
25	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0
26	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0
27	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0
28	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	28.9
29	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
30	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9
31	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9
32	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9
33	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.8
34	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8
35	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8

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